

# Implementation of Portable Decision Support Using the W3-EMRS Architecture

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**Background.** The creation of truly portable decision support systems (DSSs) remains a central goal in medical informatics. Although the Arden Syntax for Medical Logic Modules (MLMs)<sup>1</sup> represents a solid architecture for the broad dissemination of medical knowledge in coded, electronic form, it has yet to be widely implemented. A significant impediment to its use has been its inability to be functionally database independent. Although by design the Arden Syntax separates institution-specific knowledge from an MLM's logic in its *data* and *logic* slots, it still requires tailoring by each institution to its particular database query language, vocabulary, and information storage schema.

A decision support application layered above the World Wide Web Electronic Medical Record System (W3-EMRS) architecture<sup>2</sup>, which allows for unified access to remote heterogeneous electronic medical record system (EMRS) databases, solves this problem. The Adrenal Test Retrieval and Analysis System (ATRAS) is the first implementation of such an application. It has been developed as a prototypic example of a simple yet highly effective decision support tool which runs in a system-independent way.

Functional adrenal hormone testing serves as the basis for many endocrinologic diagnoses. These laboratory tests often yield large, complex data sets. Normal values for these tests depend on a patient's gender, age, pubertal development, temporal factors, and the laboratory in which the tests were performed. In addition, the ratios of certain lab values are often computed and compared to accepted "normal" values; these "normal" ratio values may also vary between institutions and laboratories. ATRAS performs all of these retrieval and analysis functions automatically.

**System.** ATRAS is written in the Java computer language, which allows for easy integration into the W3-EMRS. ATRAS retrieves all relevant adrenal hormone lab tests performed on a patient on a specified day from the hospital's EMRS. It displays this data in a table within a Java-enabled web browser, along with appropriate normal ranges. In addition, the system calculates and displays all

relevant hormonal ratios and their normal values. It highlights all abnormal values. The user may select either conventional or SI units for display. A particular challenge in this system's development has been in determining which normal values to apply to a particular patient. Should age or Tanner stage take precedence in specifying normal values? Which values are used for patients whose age falls outside of the specified ranges? User-selectable switches and analysis heuristics were developed to allow for these factors.

**Results.** ATRAS was initially implemented in February, 1997 at Boston Children's Hospital, initially as a standalone Java applet, and then later within the W3-EMRS architecture. Preliminary work with ATRAS showed a marked impact on physician time required for case analysis. ATRAS-aided analyses were performed in as much as fifteen minutes less time than when using conventional tools, per case. Anecdotal physician reports regarding satisfaction with ATRAS have been strongly positive. A formal prospective randomized evaluation study will be conducted in Fall, 1997, including data retrieval from multiple institutions.

**Conclusions.** In addition to being a fully functional tool for endocrinologists, ATRAS is the first implementation of truly portable decision support knowledge using the W3-EMRS. It represents institution-independent medical knowledge. This overcomes one of the most significant shortcomings of previous DSSs.

## References

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